(No Model.)

2 Sheets—Sheet 1.

# J. C. BAYLES & G. R. GREEN.

## SHEET METAL BENDING MACHINE.

No. 422,063. Patented Feb. 25, 1890

Fig. 4.

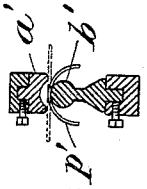



Fig. 5.

Fig. 6.

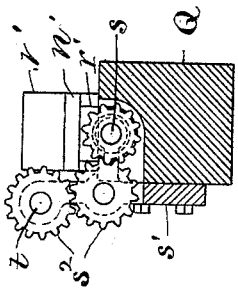
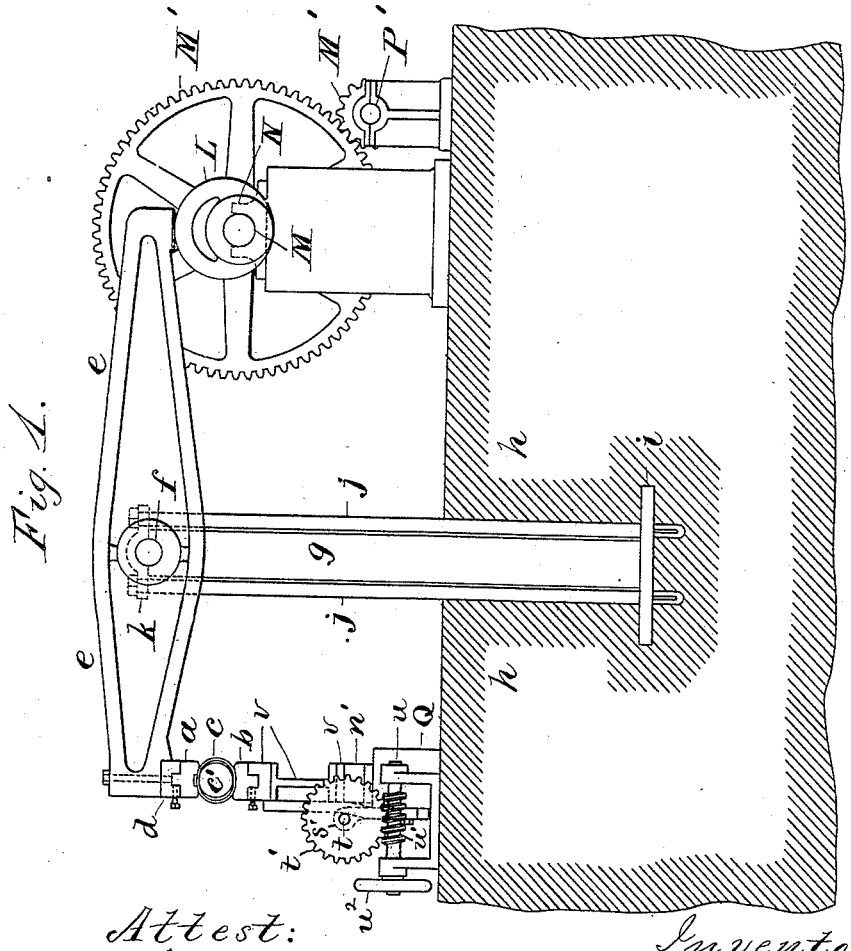



Fig. 1.

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per Crane & Miller, Attys.

(No Model.) 2 Sheets—Sheet 2.

# J. C. BAYLES & G. R. GREEN.

## SHEET METAL BENDING MACHINE.

No. 422,063. Patented Feb. 25, 1890

Fig. 2.

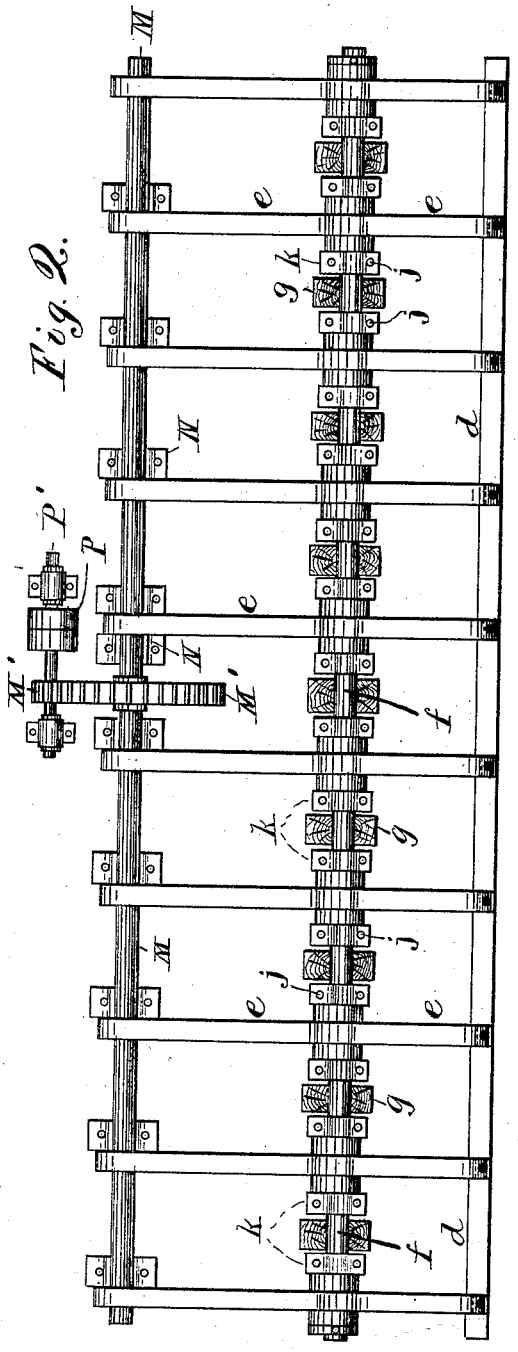
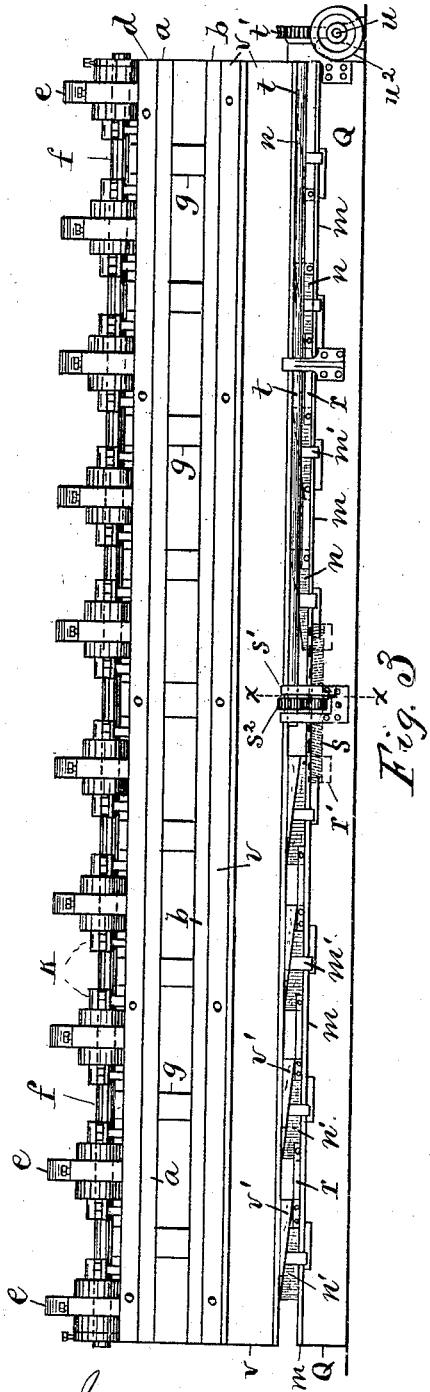



Fig. 3.




Attest:
L. Lee.
F. C. Fischer.

Inventors.
James C. Bayles,
George R. Green, per
Crane & Miller, Attys.

# UNITED STATES PATENT OFFICE.

JAMES C. BAYLES AND GEORGE R. GREEN, OF EAST ORANGE, NEW JERSEY.

## SHEET-METAL-BENDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 422,063, dated February 25, 1890.

Application filed May 29, 1889. Serial No. 312,644. (No model.)

*To all whom it may concern:*

Be it known that we, JAMES C. BAYLES and GEORGE R. GREEN, citizens of the United States, residing both at East Orange, Essex county, New Jersey, have invented certain new and useful Improvements in Sheet-Metal-Bending Machines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of this invention is to furnish an economical and effective means of bending sheets of metal longitudinally into any desired form, and the construction is especially adapted for the shaping of very long blanks for the manufacture of piping, cornices, and analogous constructions.

In this invention the movable die is sustained by a series of double-armed levers, each of which is actuated separately by a rotating crank or cam, and the series of levers and the series of cams are mounted upon continuous shafts, by which construction the capacity of the machine may be readily made of any length or extended at pleasure, if required. By sustaining the movable die at the end of a series of levers the dies and the sheet metal operated upon are placed wholly at one side of the lever-fulcra without interference from the supporting-frame of the same, by which construction all end stanchions are dispensed with, which in other machines obstruct the application of long pieces of sheet metal to the dies. The formation of closed pipes upon a mandrel is thus greatly facilitated, as no obstruction exists to the introduction or removal of the mandrel from the end of the pipe. The construction also admits of building a large machine for the manufacture of sheet-metal pipes or other cylindrical shells, as for steam-boilers, &c., up to four feet or more in diameter without heavy metallic framing, and thus greatly reduces the cost of construction.

The invention will be understood by reference to the annexed drawings, in which Figure 1 is an end view of the machine; Fig. 2, a plan of the same; Fig. 3, a front view of the same, and Figs. 4 and 5 diagrams representing alternate constructions for the dies. Fig. 6 is a section on line $x\,x$ in Fig. 3.

In Fig. 1 the dies are shown operating upon a pipe with an inclosed mandrel to close a seam upon the pipe, the upper die $a$ being adapted to form the seam, and the lower die $b$ to support the pipe $c$ and mandrel $c'$ during the seaming operation. The upper die is sustained in a die-holder $d$, formed as a continuous bar affixed to the ends of a series of levers $e$. As shown in Figs. 2 and 3, the levers are pivoted upon a stationary shaft $f$, clamped upon the tops of a series of posts $g$, which are bedded in a mass of concrete $h$, forming the floor and bed upon which the machine is erected. An anchor-plate $i$ is shown at the bottom of the post, and rods $j$ are shown keyed to the same and extended upward through metallic caps $k$, applied to the shaft $f$ at each side of the post. The top of the post is merely notched to support the shaft, and the nuts upon the rod hold the shaft firmly down into such notch. The rear ends of the levers project over a series of eccentrics L, fixed upon a continuous shaft M, which is mounted in bearings N upon a pier O in the rear of the row of posts $g$. A counter-shaft P′, provided with fast and loose pulleys P, is provided adjacent to the shaft M and connected therewith by cog-wheels M′, by which means the eccentric-shaft may be rotated at pleasure.

The machine shown is intended to operate dies twenty feet in length, and the lower die is shown sustained by adjusting mechanism supported upon the concrete floor like the pier O, parallel with the series of posts $g$.

A beam or support Q is employed to raise the lower die above the floor or bed, and its upper side is shown faced with a flat iron plate $m$, sustaining a series of wedges $n\,n'$, which are arranged in two series at the opposite sides of the center line, with their larger ends outward. Each wedge is held movably to the plate $m$ by a strap $m'$, and the wedges of each series are linked together by bars $r$, and the inner wedges of the two series are provided with nuts $r'$ and connected to a right and left hand screw $s$. This screw is mounted in a bearing $s'$, fixed at the middle of its length to the pier Q, and is rotated by cog-wheels $s^2$ and a shaft $t$, provided at one end of the pier with a worm-wheel $t'$. A

worm-shaft $u$, carrying a worm $u'$, is provided with a hand-wheel $u^2$ to rotate the worm-wheel, and thus actuate the screw $s$ as desired.

The lower die-holder $v$ is shown provided upon its under side with two series of wedges $v'$, suitably disposed to fit the faces of the wedges $n\ n'$, and it will be obvious that the movement of the wedges $n\ n'$ by means of the right and left hand screw $s$ operates to adjust the lower die-holder and the lower die to and from the die $a$.

Guides $w$ are provided upon the pier Q to restrain the lower die-holder from longitudinal or lateral movement when adjusted.

The dies are suitably constructed to press upon the sheet metal when the eccentrics L are turned upward, provision being made for the gradual approximation of the dies toward one another during the shaping operation by shifting the wedges $n\ n'$ and raising the lower die-holder as the bending of the metal progresses.

When in operation, the sheet metal is laid upon the lower die, the shaft M is set in motion, and the upper die reciprocated to and from the sheet metal to bend it as desired.

The levers which carry the upper die are projected a sufficient distance from their fulcrum-bearings to permit the introduction of any desired width of metal between the die and the supporting-posts $g$, and as the fulcrum-bearings form the entire support for the upper die it is obvious that no obstruction exists at the ends of the dies to prevent the convenient manipulation of the sheet metal or of the dies or of any mandrels that may be required for use in connection therewith.

The dies may be made of any desired shape, such as those used in making round pipes, leaders, gutters, cornices, and corrugated sheet metal, the dies in Fig. 1 showing merely the tools required to close a longitudinal seam upon a long sheet-metal pipe.

Fig. 4 shows suitable dies $a'$ and $b'$ for shaping a flat sheet of metal $p$ into such a cylindrical pipe, the edges of the blank being bent to form the seam by angular dies in the same machine or by any other means suited for the purpose. The sheet of metal to form such pipe is shown in dotted lines in Fig. 4, and the same metal, shaped by the application of the dies $a'$ and $b'$, is shown in full lines $p'$.

In Fig. 5 is shown a pair of grooved dies $q$ for corrugating sheet metal, such dies being adapted to corrugate very wide sheets by applying them in succession to different portions of its width.

The construction of this apparatus is exceedingly cheap, as the parts consist almost wholly of rough castings with very few finished parts, excepting the revolving shafts.

It is immaterial whether eccentrics like those shown in Fig. 1 be used to vibrate the rear ends of the levers, as cranks pressing directly upon the levers or linked therewith by suitable connecting-rods would produce precisely the same motion, and cams not of a circular form could also be used to produce the desired movement.

We are aware of United States Patent No. 40,897, dated December 15, 1863, which shows oscillating die-holders actuated by cams, and we are also aware that double-armed levers have been frequently actuated at one end by a cam or crank to actuate a cross-head at the opposite end, and therefore disclaim a double-armed lever for actuating a cross-head, as well as the mere use of a cam for actuating a lever.

The essential feature of our invention is the combination of a series of double-armed levers and their fulcrum with a series of posts projected upward from the bed of the machine, and with an upper die supported and guided exclusively by its attachment to the movable ends of the levers.

By sustaining the fulcrum-shaft $f$ upon posts $g$ and sustaining the strain of the shaft by anchor-plates bedded in concrete we are enabled to substitute a cheap class of masonry for a metallic bed-plate, which would be much more expensive.

Where a concrete bed is used, the pier O may be made of brick, or it might be replaced by iron pedestals resting upon the concrete $h$, and the beam or support Q, which is employed to raise the lower die above the bed, may consist of brick-work or of iron supports resting likewise upon the concrete. A metallic bed-plate would, of course, be an equivalent for the concrete bed shown in Fig. 1 of the drawings; but such construction would involve a very greatly-increased expense, as the invention is intended especially for application to very large machines, by which sheet-metal blanks from ten to forty feet in length can be bent throughout their whole length at once. It is, however, immaterial to the invention what kind of bed be used, provided it is used, as herein described, to sustain the posts, the lower die, and the bearings for the cam-shaft.

The invention is also applicable to the bending of boiler-shells and other constructions in which sheet metal is bent into cylindrical sections to be secured together by rivets or other suitable means.

It will be seen from the above description that a series of bearings projected upward from the bed is necessary to support the series of lever-fulcra upon the same line with one another, so that the levers may be attached to a common die-holder and may be operated simultaneously to actuate the same.

While it is very much better to form the fulcrum-shaft $f$ in a single piece, it is obviously not essential to the working of the apparatus, as a series of short shafts or pins would perform exactly the same function if sustained in a line with one another.

It is also obvious that the machine may be readily extended in length, if required, by adding other fulcrum-shafts in the same line, pivoting other levers thereon, piecing out

the upper die-holder to the same extent, and actuating the same by cams upon an extension of the cam-shaft M.

Having thus set forth our invention, what we claim herein is—

1. In a sheet-metal-bending machine, the combination, with a suitable bed, of a lower die and means for adjusting the same vertically upon the bed, a series of posts projected upward from the bed parallel with the lower die, a series of levers pivoted upon such posts, a continuous die-holder attached to and connecting the forward ends of the levers over the lower die, and a series of cams or cranks mounted upon a continuous shaft and rotated beneath the rear ends of the levers, as and for the purpose set forth.

2. In a sheet-metal-bending machine, the combination, with a suitable bed, of a row of posts projected upward therefrom, a continuous fulcrum-shaft secured at the tops of the posts, a series of levers pivoted thereon, a continuous die-holder connecting the forward ends of the levers, a series of cams or cranks rotated simultaneously to actuate the rear ends of the levers, a lower die-holder provided with two opposite series of wedges upon its under side, and two series of wedges sustained upon the bed-plate and adjustable to and from one another beneath the die-holder in contact with the wedges thereon to raise and lower the same at pleasure, substantially as herein set forth.

3. A sheet-metal-bending machine constructed with the concrete bed *h*, the row of posts *g*, the fulcrum-shaft *f*, fitted thereto, the anchor-plates *i*, the rods *j* and the caps *k*, for holding the fulcrum-shaft downward, the series of levers *e*, pivoted upon the fulcrum-shaft and carrying the upper holder and die *a*, the pier O, the bearings N, the shaft M, and the eccentrics L, arranged beneath the rear ends of the levers *e*, and the lower die-holder *v*, supported upon the concrete bed *h* and adjustable to and from the die-holder *d* and carrying the die *b*, the whole arranged and operated substantially as herein set forth.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

JAMES C. BAYLES.
GEORGE R. GREEN.

Witnesses:
GEO. C. HALLETT,
THOS. S. CRANE.